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(71) Applicant: **TCL CHINA STAR OPTOELECTRONICS TECHNOLOGY CO., LTD.**
Guangming New District Shenzhen Guangdong 518132 (CN)

(72) Inventor: **LI, Wei Shenzhen Guangdong 518132 (CN)**

(74) Representative: **Ström & Gulliksson AB P O Box 4188 203 13 Malmö (SE)**

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(54) **MICRO LED DISPLAY PANEL AND MICRO LED DISPLAY**

(57) Provided are a micro LED display panel and a micro LED display. The micro LED display panel comprises: a first substrate; a second substrate, a face, facing the first substrate, thereof being provided with a cathode driving circuit; N row signal lines arranged on the first substrate; an insulating layer arranged on the first sub-

strate and a row signal control line; M column signal lines arranged on the insulating layer; M compensation signal lines arranged on the insulating layer; and multiple LED light-emitting components, the multiple LED light-emitting components being arranged on the first substrate in an M-row, N-column array.

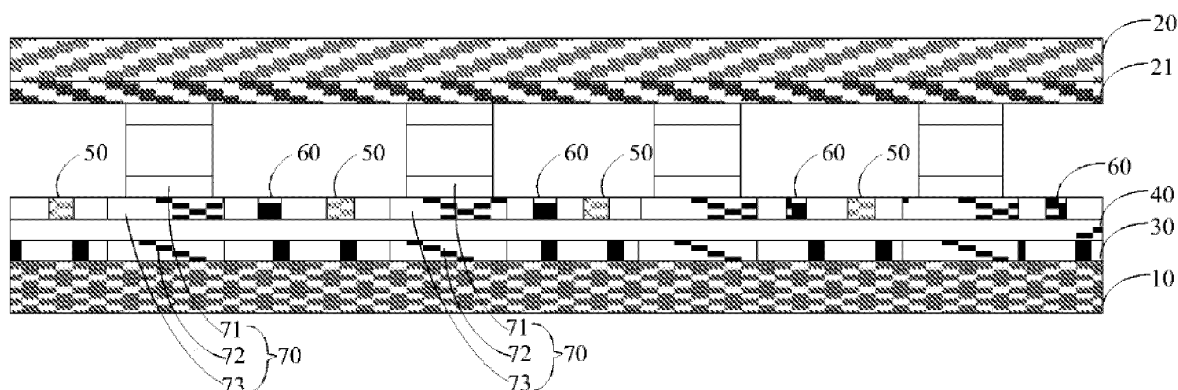


FIG. 2

Description

FIELD OF INVENTION

[0001] The present invention relates to the field of light-emitting diode (LED) displays, and in particular to a miniature LED display panel and a miniature LED display.

BACKGROUND OF DISCLOSURE

[0002] MicroLED technology is known as LED miniaturization and matrix technology. In a microLED display, an LED display driver circuit is formed by a normal complementary metal-oxide-semiconductor (CMOS) integrated circuit manufacturing process, and then an LED array is formed on the integrated circuit by a metal-organic chemical vapor deposition (MOCVD) machine.

[0003] However, the prior art has no display panel based on LED miniaturization technology, and wiring and structure of a display panel based on LED miniaturization technology are both still unknown.

[0004] Therefore, the prior art has defects and urgently needs to be improved.

SUMMARY OF INVENTION

[0005] An object of the present disclosure is to provide a miniature LED display panel and a miniature LED display.

[0006] To solve the above problem, the technical solution provided by the present disclosure is as follows:

[0007] A miniature LED display panel is provided and includes:

a first substrate;
 a second substrate having a cathode driving circuit disposed on a surface of the second substrate facing the first substrate;
 N row signal lines disposed on the first substrate;
 an insulating layer disposed on the first substrate and the row signal lines;
 M column signal lines disposed on the insulating layer;
 M compensation signal lines disposed on the insulating layer; and
 a plurality of LED light emitting components arranged in an array of M rows and N columns on the first substrate; wherein the LED light emitting components in a same row are electrically connected with a same row signal line, the LED light emitting components in a same column are electrically connected with a same compensation signal line and a same column signal line, and one end of each of the LED light emitting components away from the first substrate is connected with the second substrate and electrically connected with the cathode driving circuit; and
 wherein each of the LED light emitting components

comprises:

a first thin film transistor disposed on the first substrate and having a source electrically connected with a corresponding column signal line and a gate electrically connected with a corresponding row signal line;

a second thin film transistor disposed on the first substrate and having a source connected with a corresponding compensation signal line and a gate electrically connected with a drain of the first thin film transistor;

a first connecting metal layer disposed on the first substrate and electrically connected with a corresponding row signal line;

a second connecting metal layer disposed on the insulating layer, wherein the first connecting metal layer and the second connecting metal layer partially face each other to form a storage capacitor; and
 a light emitting unit having one end electrically connected with the cathode driving circuit and the other end electrically connected with the second connecting metal layer and a drain of the second thin film transistor;

wherein the insulating layer is a silicon nitride layer or a silicon dioxide layer;

wherein each of the first substrate and the second substrate is a glass substrate; and

wherein the light emitting unit is an inorganic LED.

[0008] In the miniature LED display panel in the disclosure, the light emitting unit is formed on the first substrate by using a screen printing process, a spraying process, or a silver paste dot printing process.

[0009] In the miniature LED display panel in the disclosure, the row signal lines, the column signal lines, and the compensation signal lines are all formed by photolithography.

[0010] A miniature LED display panel is also provided and includes:

a first substrate;
 a second substrate having a cathode driving circuit disposed on a surface of the second substrate facing the first substrate;
 N row signal lines disposed on the first substrate;
 an insulating layer disposed on the first substrate and the row signal lines;
 M column signal lines disposed on the insulating layer;
 M compensation signal lines disposed on the insulating layer; and
 a plurality of LED light emitting components arranged in an array of M rows and N columns on the first substrate; wherein the LED light emitting components in a same row are electrically connected with a same row signal line, the LED light emitting components in a same column are electrically connected with a same compensation signal line and a same

the column signal line, and one end of each of the LED light emitting components away from the first substrate is connected with the second substrate and electrically connected with the cathode driving circuit.

[0011] In the miniature LED display panel in the disclosure, each of the LED light emitting components comprises:

a first thin film transistor disposed on the first substrate and having a source electrically connected with a corresponding column signal line and a gate electrically connected with a corresponding row signal line;
 a second thin film transistor disposed on the first substrate and having a source connected with a corresponding compensation signal line and a gate electrically connected with a drain of the first thin film transistor;
 a first connecting metal layer disposed on the first substrate and electrically connected with a corresponding row signal line;
 a second connecting metal layer disposed on the insulating layer, wherein the first connecting metal layer and the second connecting metal layer partially face each other to form a storage capacitor; and
 a light emitting unit having one end electrically connected with the cathode driving circuit and the other end electrically connected with the second connecting metal layer and a drain of the second thin film transistor.

[0012] In the miniature LED display panel in the disclosure, the insulating layer is a silicon nitride layer or a silicon dioxide layer.

[0013] In the miniature LED display panel in the disclosure, each of the first substrate and the second substrate is a glass substrate.

[0014] In the miniature LED display panel in the disclosure, the light emitting unit is an inorganic LED.

[0015] In the miniature LED display panel in the disclosure, the light emitting unit is disposed on the first substrate by using a screen printing process.

[0016] In the miniature LED display panel in the disclosure, the light emitting unit is disposed on the first substrate by using a spraying process.

[0017] In the miniature LED display panel in the disclosure, the light emitting unit is disposed on the first substrate by using a silver paste dot printing process.

[0018] In the miniature LED display panel in the disclosure, the row signal lines, the column signal lines, and the compensation signal lines are all formed by photolithography.

[0019] A miniature LED display is provided and includes a miniature LED display panel, and the miniature LED display panel includes:

a first substrate;

a second substrate having a cathode driving circuit disposed on a surface of the second substrate facing the first substrate;

N row signal lines disposed on the first substrate; an insulating layer disposed on the first substrate and the row signal lines;

M column signal lines disposed on the insulating layer;

M compensation signal lines disposed on the insulating layer; and

a plurality of LED light emitting components arranged in an array of M rows and N columns on the first substrate; wherein the LED light emitting components in a same row are electrically connected with a same row signal line, the LED light emitting components in a same column are electrically connected with a same compensation signal line and a same column signal line, and one end of each of the LED light emitting components away from the first substrate is connected with the second substrate and electrically connected with the cathode driving circuit.

[0020] In the miniature LED display in the disclosure, each of the LED light emitting components comprises:

a first thin film transistor disposed on the first substrate and having a source electrically connected with a corresponding column signal line and a gate electrically connected with a corresponding row signal line;

a second thin film transistor disposed on the first substrate and having a source connected with a corresponding compensation signal line and a gate electrically connected with a drain of the first thin film transistor;

a first connecting metal layer disposed on the first substrate and electrically connected with a corresponding row signal line;

a second connecting metal layer disposed on the insulating layer, wherein the first connecting metal layer and the second connecting metal layer partially face each other to form a storage capacitor; and

a light emitting unit having one end electrically connected with the cathode driving circuit and the other end electrically connected with the second connecting metal layer and a drain of the second thin film transistor.

[0021] In the miniature LED display in the disclosure, the insulating layer is a silicon nitride layer or a silicon dioxide layer.

[0022] In the miniature LED display in the disclosure, each of the first substrate and the second substrate is a glass substrate.

[0023] In the miniature LED display in the disclosure, the light emitting unit is an inorganic LED.

[0024] In the miniature LED display in the disclosure, the light emitting unit is disposed on the first substrate by using a screen printing process, a spraying process, or a silver paste dot printing process.

[0025] In the miniature LED display in the disclosure, the row signal lines, the column signal lines, and the compensation signal lines are all formed by photolithography.

[0026] Compared with the prior art, the functions of the miniature LED display panel and the miniature LED display are achieved in the present disclosure by disposing the cathode driving circuit on the first substrate and disposing the row signal lines, the column signal lines, and the compensation signals on the second substrate. The light emitting switch control and the luminous flux control of the light emitting components are achieved by the row signal lines, the column signal lines, and the compensation signal lines.

BRIEF DESCRIPTION OF DRAWINGS

[0027]

FIG. 1 is a planar structural schematic diagram of a miniature LED display panel in the present disclosure.

FIG. 2 is a cross-sectional structural schematic diagram of the miniature LED display panel in the present disclosure.

FIG. 3 is a partial circuit diagram of the miniature LED display panel in the present disclosure.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0028] The following description of the embodiments with reference to the accompanying drawings is used to illustrate particular embodiments of the present disclosure. The directional terms referred to in the present disclosure, such as "upper", "lower", "front", "back", "left", "right", "inner", "outer", "side surface", etc., are only directions with regard to the accompanying drawings. Therefore, the directional terms used for describing and illustrating the present disclosure are not intended to limit the present disclosure.

[0029] In the drawings, modules with similar structures are indicated by same reference number.

[0030] Refer to FIGs. 1, 2, and 3. The miniature LED display panel includes a first substrate 10, a second substrate 20, N row signal lines 30, an insulating layer 40, M column signal lines 50, M compensation signal lines 60, and a plurality of LED light emitting components 70. The plurality of LED light emitting components 70 are arranged in an array.

[0031] The first substrate 10 is a glass substrate.

[0032] The second substrate 20 is a glass substrate. A cathode driving circuit 21 is disposed on a surface of the second substrate 20 facing the first substrate 10. The cathode driving circuit 21 may be formed on the second

substrate 20 by photolithography.

[0033] The N row signal lines 30 are all disposed on the first substrate 10. Each of the row signal lines 30 is configured to provide a first electrical signal to the corresponding LED light emitting component 70.

[0034] The insulating layer 40 is disposed on the first substrate 10 and the row signal control lines 30. The insulating layer 40 may be a silicon nitride layer or a silicon dioxide layer, and is formed by chemical vapor deposition.

[0035] The M column signal lines 50 are disposed on the insulating layer 40. Each of the column signal lines 60 is configured to provide a second electrical signal to the corresponding LED light emitting component 70.

[0036] The M compensation signal lines 60 are disposed on the insulation layer 40. Each of the compensation signal lines 60 is configured to provide a compensation signal to the corresponding LED light emitting component 70.

[0037] The plurality of LED light emitting components 70 are arranged in an array of M rows and N columns on the first substrate 10. One end of each of the LED light emitting components 70 away from the first substrate 10 is connected with the second substrate 20 and electrically connected with the cathode driving circuit 21. Each of the LED light emitting units 70 is electrically connected with the corresponding row signal line 30, the corresponding compensation signal line 60, and the corresponding column signal line 50.

[0038] In actual manufacture, the row signal lines, the column signal lines, and the compensation signal lines are formed using photolithography. Each of the row signal lines 30 includes a first sub-row signal line 30a and a second sub-row signal line 30b.

[0039] Each of the LED light emitting components 70 includes a light emitting unit 71, a first connecting metal layer 72, a second connecting metal layer 73, a first thin film transistor 75, and a second thin film transistor 74.

[0040] The light emitting unit 71 is an inorganic LED. The light emitting unit 71 may be formed on the first substrate 10 by a spraying process. Alternatively, the light emitting unit 71 may be formed on the first substrate 10 by a silver paste dot printing process. Alternatively, the light emitting unit 71 may be formed on the first substrate 10 by a screen printing process.

[0041] The first thin film transistor 75 is disposed on the first substrate 10, and has a source electrically connected with a corresponding column signal line 50, a gate electrically connected with the corresponding second sub-row signal line 30b of the row signal lines 30, and a drain electrically connected with a gate of the second thin film transistor 74. The second thin film transistor 74 is disposed on the first substrate 10, and has a source electrically connected with a corresponding compensation signal line 60.

[0042] The first connecting metal layer 72 is disposed on the first substrate 10 and located on the same layer as the row signal lines 30. The first connecting metal

layer 72 is electrically connected with the first sub-row signal line 30a of the row signal lines 30. Firstly, a metal layer is formed on the first substrate 10, and then the metal layer is patterned to respectively form the plurality of row signal lines 30 and the first connecting metal layer 72.

[0043] The second connecting metal layer 73 is disposed on the first substrate 10. Specifically, the second connecting metal layer 73 is disposed on the insulating layer 40. The first connecting metal layer 72 and the second connecting metal layer 73 partially face each other to form a storage capacitor C. The second connecting metal layer 73 is located on the same layer as the column signal lines 50 and the compensation signal lines 60. The anode of the light emitting unit 71 is connected with the second connecting metal layer 73 and a drain of the second thin film transistor 74. The cathode of the light emitting unit 71 is electrically connected with the cathode driving circuit 21 on the second substrate 20.

[0044] In actual manufacture, firstly, a metal layer is formed on the insulating layer 40, and then the metal layer is patterned to respectively form the second connecting layer 73, the column signal lines 50, and the compensation signal lines 60.

[0045] In operation, the column signal lines provide the second electrical signal to the sources of the first thin film transistors, the row signal lines provide the first electrical signal to the storage capacitors C1 and the gates of the first thin film transistors, and the compensation signal lines provide a compensation voltage signal to the sources of the second thin film transistors. The first electrical signal supplies power to the anodes of the light emitting units through the storage capacitors C1, so as to drive the light emitting units to emit light. The first electrical signal turns on the first thin film transistors, so that the second electrical signal is transmitted to the gates of the second thin film transistors, thereby turning on the second thin film transistors. The second thin film transistors are turned on, so that the compensation voltage signal is transmitted to the anodes of the light emitting units to increase the compensation current provided to the light emitting units, thereby adjusting the light emitting brightness thereof.

[0046] An embodiment of the present disclosure further provides a miniature LED display, including the miniature LED display panel in the above embodiments.

[0047] Compared with the prior art, the functions of the miniature LED display panel and the miniature LED display are achieved in the present disclosure by disposing the cathode driving circuit on the first substrate and disposing the row signal lines, the column signal lines, and the compensation signals on the second substrate. The light emitting switch control and the luminous flux control of the light emitting components are achieved by the row signal lines, the column signal lines, and the compensation signal lines.

[0048] In summary, although the preferable embodiments of the present disclosure have been disclosed

above, the embodiments are not intended to limit the present disclosure. A person of ordinary skill in the art, without departing from the spirit and scope of the present disclosure, can make various modifications and variations. Therefore, the scope of the disclosure is defined in the claims.

Claims

1. A miniature LED display panel comprising:

a first substrate;
a second substrate having a cathode driving circuit disposed on a surface of the second substrate facing the first substrate;
N row signal lines disposed on the first substrate;
an insulating layer disposed on the first substrate and the row signal lines;
M column signal lines disposed on the insulating layer;
M compensation signal lines disposed on the insulating layer; and
a plurality of LED light emitting components arranged in an array of M rows and N columns on the first substrate;
wherein the LED light emitting components in a same row are electrically connected with a same row signal line, the LED light emitting components in a same column are electrically connected with a same compensation signal line and a same column signal line, and one end of each of the LED light emitting components away from the first substrate is connected with the second substrate and electrically connected with the cathode driving circuit; and
wherein each of the LED light emitting components comprises:

a first thin film transistor disposed on the first substrate and having a source electrically connected with a corresponding column signal line and a gate electrically connected with a corresponding row signal line;
a second thin film transistor disposed on the first substrate and having a source connected with a corresponding compensation signal line and a gate electrically connected with a drain of the first thin film transistor;
a first connecting metal layer disposed on the first substrate and electrically connected with a corresponding row signal line;
a second connecting metal layer disposed on the insulating layer, wherein the first connecting metal layer and the second connecting metal layer partially face each other to form a storage capacitor; and
a light emitting unit having one end electri-

- cally connected with the cathode driving circuit and the other end electrically connected with the second connecting metal layer and a drain of the second thin film transistor; wherein the insulating layer is a silicon nitride layer or a silicon dioxide layer; wherein each of the first substrate and the second substrate is a glass substrate; and wherein the light emitting unit is an inorganic LED.
2. The miniature LED display panel as claimed in claim 1, wherein the light emitting unit is formed on the first substrate by using a screen printing process, a spraying process, or a silver paste dot printing process.
 3. The miniature LED display panel as claimed in claim 1, wherein the row signal lines, the column signal lines, and the compensation signal lines are all formed by photolithography.
 4. A miniature LED display panel comprising:
 - a first substrate;
 - a second substrate having a cathode driving circuit disposed on a surface of the second substrate facing the first substrate;
 - N row signal lines disposed on the first substrate;
 - an insulating layer disposed on the first substrate and the row signal lines;
 - M column signal lines disposed on the insulating layer;
 - M compensation signal lines disposed on the insulating layer; and
 - a plurality of LED light emitting components arranged in an array of M rows and N columns on the first substrate;
 - wherein the LED light emitting components in a same row are electrically connected with a same row signal line, the LED light emitting components in a same column are electrically connected with a same compensation signal line and a same column signal line, and one end of each of the LED light emitting components away from the first substrate is connected with the second substrate and electrically connected with the cathode driving circuit.
 5. The miniature LED display panel as claimed in claim 4, wherein each of the LED light emitting components comprises:
 - a first thin film transistor disposed on the first substrate and having a source electrically connected with a corresponding column signal line and a gate electrically connected with a corresponding row signal line;
 - a second thin film transistor disposed on the first substrate and having a source connected with a corresponding compensation signal line and a gate electrically connected with a drain of the first thin film transistor;
 - a first connecting metal layer disposed on the first substrate and electrically connected with a corresponding row signal line;
 - a second connecting metal layer disposed on the insulating layer, wherein the first connecting metal layer and the second connecting metal layer partially face each other to form a storage capacitor; and
 - a light emitting unit having one end electrically connected with the cathode driving circuit and the other end electrically connected with the second connecting metal layer and a drain of the second thin film transistor.
 6. The miniature LED display panel as claimed in claim 5, wherein the insulating layer is a silicon nitride layer or a silicon dioxide layer.
 7. The miniature LED display panel as claimed in claim 5, wherein each of the first substrate and the second substrate is a glass substrate.
 8. The miniature LED display panel as claimed in claim 5, wherein the light emitting unit is an inorganic LED.
 9. The miniature LED display panel as claimed in claim 5, wherein the light emitting unit is disposed on the first substrate by using a screen printing process.
 10. The miniature LED display panel as claimed in claim 5, wherein the light emitting unit is disposed on the first substrate by using a spraying process.
 11. The miniature LED display panel as claimed in claim 5, wherein the light emitting unit is disposed on the first substrate by using a silver paste dot printing process.
 12. The miniature LED display panel as claimed in claim 4, wherein the row signal lines, the column signal lines, and the compensation signal lines are all formed by photolithography.
 13. A miniature LED display comprising a miniature LED display panel, the miniature LED display panel comprising:
 - a first substrate;
 - a second substrate having a cathode driving circuit disposed on a surface of the second substrate facing the first substrate;
 - N row signal lines disposed on the first substrate;
 - an insulating layer disposed on the first sub-

- strate and the row signal lines;
M column signal lines disposed on the insulating layer;
M compensation signal lines disposed on the insulating layer; and
a plurality of LED light emitting components arranged in an array of M rows and N columns on the first substrate;
wherein the LED light emitting components in a same row are electrically connected with a same row signal line, the LED light emitting components in a same column are electrically connected with a same compensation signal line and a same column signal line, and one end of each of the LED light emitting components away from the first substrate is connected with the second substrate and electrically connected with the cathode driving circuit.
14. The miniature LED display as claimed in claim 13, wherein each of the LED light emitting components comprises:
- a first thin film transistor disposed on the first substrate and having a source electrically connected with a corresponding column signal line and a gate electrically connected with a corresponding row signal line;
 - a second thin film transistor disposed on the first substrate and having a source connected with a corresponding compensation signal line and a gate electrically connected with a drain of the first thin film transistor;
 - a first connecting metal layer disposed on the first substrate and electrically connected with a corresponding row signal line;
 - a second connecting metal layer disposed on the insulating layer, wherein the first connecting metal layer and the second connecting metal layer partially face each other to form a storage capacitor; and
 - a light emitting unit having one end electrically connected with the cathode driving circuit and the other end electrically connected with the second connecting metal layer and a drain of the second thin film transistor.
15. The miniature LED display as claimed in claim 14, wherein the insulating layer is a silicon nitride layer or a silicon dioxide layer.
16. The miniature LED display as claimed in claim 14, wherein each of the first substrate and the second substrate is a glass substrate.
17. The miniature LED display as claimed in claim 14, wherein the light emitting unit is an inorganic LED.
18. The miniature LED display as claimed in claim 14, wherein the light emitting unit is disposed on the first substrate by using a screen printing process, a spraying process, or a silver paste dot printing process.
19. The miniature LED display as claimed in claim 13, wherein the row signal lines, the column signal lines and the compensation signal lines are all formed by photolithography.

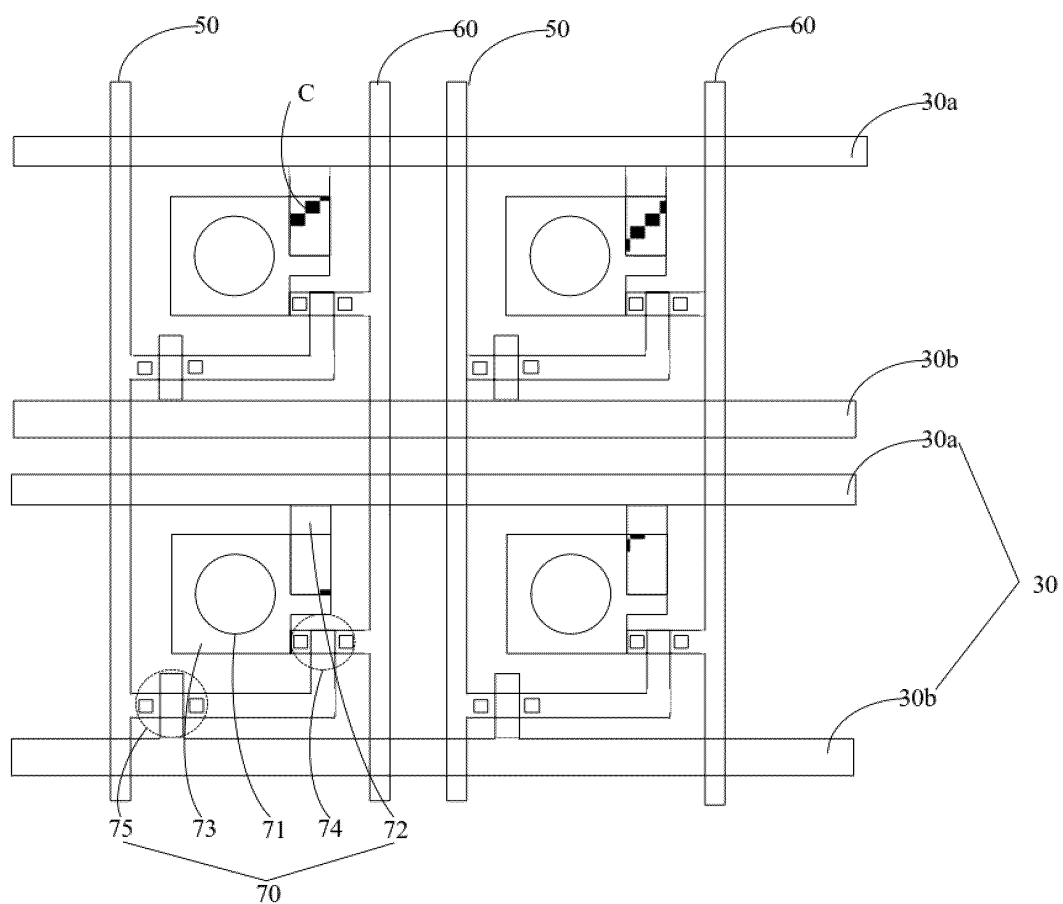


FIG. 1

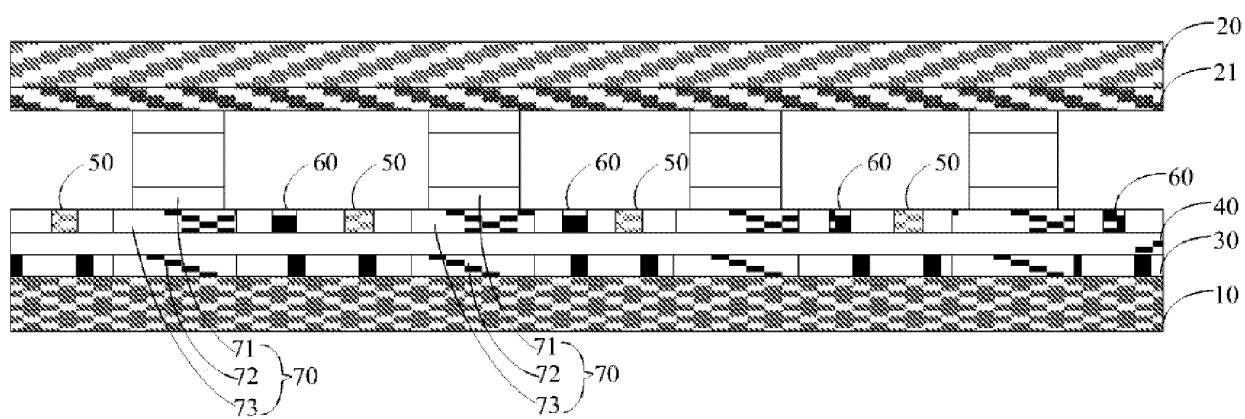


FIG. 2

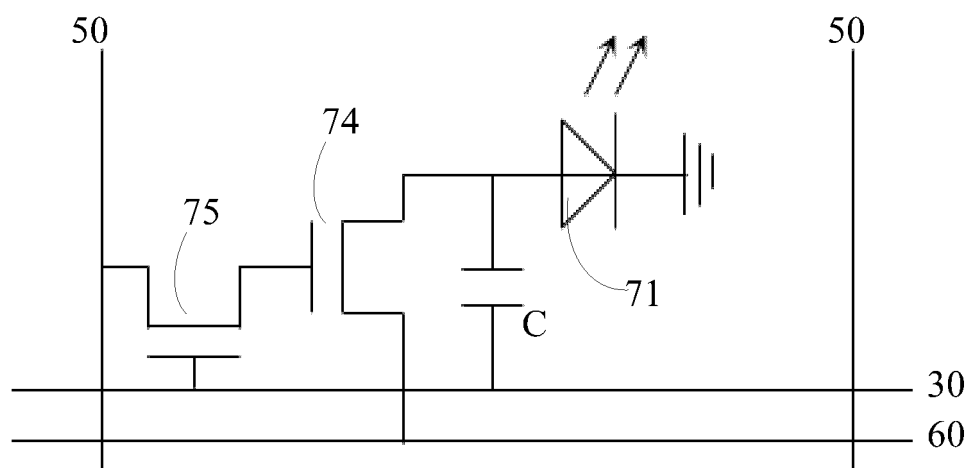


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/111253

A. CLASSIFICATION OF SUBJECT MATTER H01L 27/12(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC																					
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H01L,G09G Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNTXT, CNABS: 面板, 平板, 极, 栅, 源, 漏, 补偿, 阴极, 阳极, 微, 小, 储能, 充电, 存储, 电容, 下, 上, 第一, 基板, 基底, 衬底; VEN, WOTXT, USTXT, EPTXT: small+, substrat+, micro+, tiny+, LED, wee+.																					
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>CN 106652820 A (GOERTEK INC.) 10 May 2017 (2017-05-10) description, paragraphs [0034]-[0040], and figures 3-6</td> <td>4, 12, 13, 19</td> </tr> <tr> <td>Y</td> <td>CN 104681568 A (SEMICONDUCTOR ENERGY LABORATORY CO., LTD.) 03 June 2015 (2015-06-03) description, paragraphs [0488]-[0502], and figure 15</td> <td>4, 12, 13, 19</td> </tr> <tr> <td>A</td> <td>CN 104882096 A (SHENZHEN CHINA STAR OPTOELECTRONICS TECHNOLOGY CO., LTD.) 02 September 2015 (2015-09-02) entire document</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>CN 106356379 A (JIANGSU XINGUANGLIAN SEMICONDUCTOR CO., LTD.) 25 January 2017 (2017-01-25) entire document</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>GB 2531558 A (INFINILED LTD.) 27 April 2016 (2016-04-27) entire document</td> <td>1-19</td> </tr> <tr> <td>A</td> <td>US 2015333221 A1 (LUXVUE TECHNOLOGY CORP.) 19 November 2015 (2015-11-19) entire document</td> <td>1-19</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	CN 106652820 A (GOERTEK INC.) 10 May 2017 (2017-05-10) description, paragraphs [0034]-[0040], and figures 3-6	4, 12, 13, 19	Y	CN 104681568 A (SEMICONDUCTOR ENERGY LABORATORY CO., LTD.) 03 June 2015 (2015-06-03) description, paragraphs [0488]-[0502], and figure 15	4, 12, 13, 19	A	CN 104882096 A (SHENZHEN CHINA STAR OPTOELECTRONICS TECHNOLOGY CO., LTD.) 02 September 2015 (2015-09-02) entire document	1-19	A	CN 106356379 A (JIANGSU XINGUANGLIAN SEMICONDUCTOR CO., LTD.) 25 January 2017 (2017-01-25) entire document	1-19	A	GB 2531558 A (INFINILED LTD.) 27 April 2016 (2016-04-27) entire document	1-19	A	US 2015333221 A1 (LUXVUE TECHNOLOGY CORP.) 19 November 2015 (2015-11-19) entire document	1-19
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Y	CN 106652820 A (GOERTEK INC.) 10 May 2017 (2017-05-10) description, paragraphs [0034]-[0040], and figures 3-6	4, 12, 13, 19																			
Y	CN 104681568 A (SEMICONDUCTOR ENERGY LABORATORY CO., LTD.) 03 June 2015 (2015-06-03) description, paragraphs [0488]-[0502], and figure 15	4, 12, 13, 19																			
A	CN 104882096 A (SHENZHEN CHINA STAR OPTOELECTRONICS TECHNOLOGY CO., LTD.) 02 September 2015 (2015-09-02) entire document	1-19																			
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A	GB 2531558 A (INFINILED LTD.) 27 April 2016 (2016-04-27) entire document	1-19																			
A	US 2015333221 A1 (LUXVUE TECHNOLOGY CORP.) 19 November 2015 (2015-11-19) entire document	1-19																			
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Name and mailing address of the ISA/CN State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088 China Facsimile No. (86-10)62019451	Authorized officer Telephone No.																				

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2017/111253

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 106652820 A	10 May 2017	None	
CN 104681568 A	03 June 2015	JP 2016128913 A	14 July 2016
		JP 5154627 B2	27 February 2013
		US 2011090207 A1	21 April 2011
		TW 201727611 A	01 August 2017
		TW 201638919 A	01 November 2016
		KR 20120096463 A	30 August 2012
		US 2016035275 A1	04 February 2016
		SG 178058 A1	29 March 2012
		CN 104681568 B	21 November 2017
		KR 101582636 B1	07 January 2016
		KR 20170102395 A	08 September 2017
		JP 2011141524 A	21 July 2011
		US 2015070254 A1	12 March 2015
		JP 2017017356 A	19 January 2017
		TW 1588802 B	21 June 2017
		TW 1506611 B	01 November 2015
		US 8890781 B2	18 November 2014
		EP 2491594 A4	16 September 2015
		TW 1553607 B	11 October 2016
		JP 2013092783 A	16 May 2013
		TW 201207815 A	16 February 2012
		US 9165502 B2	20 October 2015
		WO 2011048924 A1	28 April 2011
		KR 101293261 B1	09 August 2013
		TW 201543440 A	16 November 2015
		JP 2015092575 A	14 May 2015
		KR 20120079830 A	13 July 2012
		KR 20140026659 A	05 March 2014
		JP 5947864 B2	06 July 2016
		EP 2491594 A1	29 August 2012
		CN 107731931 A	23 February 2018
		CN 102576734 B	22 April 2015
		CN 102576734 A	11 July 2012
		IN 201202138 P1	16 November 2015
CN 104882096 A	02 September 2015	US 2016358544 A1	08 December 2016
		WO 2016192143 A1	08 December 2016
CN 106356379 A	25 January 2017	None	
GB 2531558 A	27 April 2016	GB 201418769 D0	03 December 2014
US 2015333221 A1	19 November 2015	WO 2015175131 A1	19 November 2015
		TW 1570908 B	11 February 2017
		US 9318475 B2	19 April 2016
		TW 201547015 A	16 December 2015

Form PCT/ISA/210 (patent family annex) (January 2015)